creative computing software

TRS-80   CS-3006

(16k Level II)

AIR TRAFFIC CONTROLLER

by David Mannering

**AIR TRAFFIC CONTROL
COMPUTER GAME
FOR TRS-80 LEVEL II 18K**

Air Traffic Controller (ATC) is a machine language simulation for the TRS-80 of the situation faced by an air traffic controller.

Load the tape from the system monitor. After entering Level II BASIC, type SYSTEM and press ENTER. The computer will respond *?. Type ATC, press ENTER and the tape will begin to load. One star should blink slowly in the upper-right-hand corner of the screen. If the star does not blink or a C appears, try adjusting the volume on the recorder.

After the program has loaded, press / and press ENTER. The radar display will appear on the screen. To begin the game, select the number of minutes you wish to play (between 16 and 99). This is the amount of time you have to process all twenty-six aircraft. After typing the number of minutes, press ENTER. The simulation will then begin.

The record time for successfully completing this simulation stands at 21, which is truly outstanding. Novice Air Traffic Controllers should try a time of 65 or higher to start.

The Situation

You are an air traffic controller with the responsibility for the flow of air traffic within an area of 15 x 25 miles, from ground level to 5,000 feet altitude. Within this area are two airports, two navigational aids, and ten entry/exit fixes (see attached diagram). During the course of the game 26 aircraft will become active inside this area. Your specific responsibility is to guide each of these aircraft to its predetermined destination within certain time and safety restrictions.

The Screen

Think of the screen as a computer-assisted radar scope. The dots are mile markers, and the distance between two adjacent dots, either vertically, horizontally, or diagonally, is one mile. The airports, navaids, and entry/exit fixes are depicted on the screen in their proper locations. An aircraft will appear on the screen as a capital letter, which is the aircraft's call-sign, followed by a single decimal digit, which is the aircraft's altitude in thousands of feet. The call-sign will always be centered on a mile marker.

In the lower left corner of the screen, below the radar area, is the instruction display area. When you enter an instruction on the keyboard it will appear here. To the right of this area is the status display area. This area will display responses to instructions and game status information. The game clock is in this area. To the right of the radar area, stretching from the top to the bottom of the screen, is the aircraft information area. This area will display aircraft speed, destination, fuel supply, and other timely information.

Aircraft

Speed: An aircraft is either a jet, which flies 4 miles per minute, or a propeller craft which flies 2 miles per minute. The radar display is updated every 15 seconds. Each jet, then, will move one mile per update, and

propeller craft will move one mile every second update.

Altitude: Aircraft remain in level flight unless you instruct them to climb or descend. In level flight they are always at multiples of 1,000 feet. They climb or descend at the rate of 1,000 feet per mile. The altitude readout (the digit next to the call sign) gives an accurate indication of the aircraft's altitude up to 9,000 feet (Aircraft above that altitude are extremely rare). Aircraft flying at 0 altitude are in landing configuration; i.e., they will accept no further altitude or heading instructions.

Heading: Aircraft may fly vertically, horizontally, or diagonally on the screen. Aircraft flying toward the top of the screen are considered to be heading north. Turn instructions are issued in multiples of 45 degrees. Aircraft will fly in a straight line unless instructed otherwise. Aircraft may turn at the rate of 45 degrees per mile except when making an instrument approach to an airport, at which time they make a turn of up to 180 degrees while over a navaid.

Active/Inactive: An inactive aircraft is one that has not yet entered or has already left your control area. The computer randomly determines at what time during the game each aircraft becomes active. You may display certain information on inactive aircraft, but you may not issue them instructions.

Fuel: Jets have enough fuel to last 15 minutes after they become active, while propellor craft have enough for 21 minutes. Active departures waiting on the ground for take-off instructions use fuel at the same rate as if they were airborne.

Arrivals/Departures: Aircraft can enter your area in one of two ways: They can fly in from one of the entry/exit fixes, or they can begin on the ground at one of the airports. Conversely, aircraft can leave your control area by flying out via an entry/exit fix or by landing at one of the airports. Aircraft which enter via an entry/exit fix are called arrivals, and they will initially fly directly toward the opposite fix on the screen (opposite fixes are nine's complements, a navaid. If its destination is the opposite fix it will continue straight ahead. If its destination is an

airport it will hold (circle) at the navaid (this assumes that you have not instructed it to do otherwise). Departures become active on the ground at an airport, but will not become airborne until you give the instruction to do so. After is it instructed to take off it will appear airborne one mile from the airport flying on the approach heading for that airport. It will be at 1,000 feet at climbing toward its assigned altitude.

General: Aircraft are updated in alphabetical order. When two or more aircraft occupy the same position on the screen, the last one updated will be displayed regardless of altitude.

Requirements

All aircraft with destinations of entry/exit fixes must exit via their proper fix (it must be the last position occupied before they leave the screen) and they must be level at 5,000 feet at that fix. Failure to meet these conditions results in a boundary error.

All active aircraft must be separated by at least 3 miles or at least 1,000 feet of altitude at all times. Failure to adhere to this separation results in a conflict error. Aircraft that are climbing or descending are considered to be at both their old and new altitude for conflict purposes. Departures assigned take-off instructions but not yet airborne are at 0 altitude. Updates occur in alphabetical order with each aircraft checked against all other aircraft which are assumed to be stationary in position and altitude.

An aircraft must reach its destination before it runs out of fuel.

All aircraft must reach their destinations before the game clock reaches 0.

A landing aircraft must be landing at its destination airport, level at 0 altitude, and flying the approach heading for the airport (see approach headings). Failure to meet these conditions will cause a "go around" when the aircraft reaches an airport. A "go around" results in the aircraft climbing or descending to 1,000 feet and continuing on its last issued heading. Aircraft are assumed to be landing at the first airport encoun-

tered after an "A0" instruction (see instructions) This is the only error that will not end the game.

Instructions

To issue an instruction to a specific aircraft, first enter the aircraft's call sign (a capital letter), then enter the letter signifying the type of instruction (A for altitude, L for left turn, R for right turn), then enter a digit to indicate the magnitude of the instruction (0-5).

After being given an "A" instruction, the aircraft will climb or descend at the rate of 1,000 feet per mile until reaching the assigned altitude. The top of your area is 5,000 feet, and you will be unable to climb an aircraft higher than that; however, all arrivals will enter your area above 5,000 feet and you may leave them at their initial altitude as long as you want. When you descend them they cannot be stopped before reaching 5,000 feet (most arrivals will be at 6,000', but to avoid conflicts the computer assigns aircraft due to become active within two minutes of another at the same fix different altitudes). "A0" causes the aircraft the descend to 0 altitude, but is also causes the aircraft to ignore all further instructions. It should only be issued when the aircraft is about to land.

To instruct an aircraft to take-off, you merely assign it an altitude (do not assign it 0). It will become airborne on the next appropriate update and climb to the assigned altitude on the approach heading for the airport.

After being issued an "L1-L4" instruction the aircraft will continue straight ahead for one mile, then turn left at the rate of 45 degrees per mile until the assigned turn is completed. The "L0" instruction causes the aircraft to fly straight ahead until encountering a navaid, at which time it begins to make continuous left 45 degree turns, which results in it flying in a circle which intersects the navaid (see diagram). This is known as holding. It will continue to hold until instructed to do otherwise. The "L5" instruction causes the aircraft to fly straight ahead until encountering a navaid, at which time it assumes the approach heading for # airport. It assumes this heading immediately,

not at the rate of 45 degrees per mile.

The "R1-R4" instruction works just like "L1-L4" except the turns are toward the right. The "R0" instruction causes the aircraft to fly straight ahead. This is useful for allowing an aircraft to fly over a navaid it was previously assigned to hold at, and to stop turns before they are completed. The "R5" instruction works just like "L5" except the heading assumed is the approach heading for % airport.

Here is a chart of aircraft instructions:

	A	L	R
0	Descend to 0' Cleared to land	Hold at Navald	Continue Straight ahead
1	Climb/Descend to 1,000'	Turn left 45 degrees	Turn right 45 degrees
2	Climb/Descend to 2,000'	Turn left 90 degrees	Turn right 90 degrees
3	Climb/Descend to 3,000'	Turn left 135 degrees	Turn right 135 degrees
4	Climb/Descend to 4,000'	Turn left 180 degrees	Turn right 180 degrees
5	Climb/Descend to 5,000'	Cleared for # Approach	Cleared for % Approach

Approach headings: The approach heading for # airport is due west, toward fix 9; for the % airport it is northwest, toward fix 2. All landings must be made on these headings and all departures will be made on these headings. You may assign a turn to a departure after it is cleared for take-off, but not before.

If an aircraft is already holding, "L0" has no effect, "L5" and "R5" cause the appropriate heading to be assumed when the aircraft next reaches the navaid in its holding circle. All other instructions operate as normal. All inbounds have been initially assigned to hold.

Information Requests

To request information on a specific aircraft, enter the aircraft's call sign, then press ENTER. The information will appear at the bottom of the information area on the screen, to the right of the clock, in the following format:

Call sign, speed, altitude, (space), initial airport or fix, (arrow), destination, (space), heading, (space), fuel

The speed will either be 'J' for jet or 'P' for prop. Altitude is in thousands of feet. Airports and fixes are as displayed on the map (if the aircraft is active, its current position, which may be a dot, will be displayed instead of its initial position). Heading is displayed as one or two upper-case letters (N is north, NE is northeast, etc.). Fuel is displayed in minutes remaining, and will be a plus if it's 10 or more. Here is an example:

BJ67 → #SW 9

This request may be made of active or inactive aircraft.

One minute before inbounds and overflights become active, they will appear in the aircraft information area in the above format. You will then have one minute to prepare for their arrival on the screen. Departures will appear in the information area as they become active. You may then clear them for take-off if you wish, or you can leave them on the ground. They will stay in the information area until cleared. Arrivals and overflights disappear from the information area as soon as they appear in your control area. You must then do a specific information request if you have forgotten where they were going or if you want a fuel check.

Responses

After entering an instruction or information request, press the ENTER key. If your entry has been processed it will be acknowledged with "ROGER" in the status area. If you attempt to issue an instruction to an inactive aircraft, to an aircraft after it has been given an "A0" instruction (unless it has performed a "go around"), or a turn to a non-cleared-takeoff departure, —UNABLE— will appear in the status area. No further entries will be processed until the status area is cleared, which you can do by pressing any key, or by letting it clear automatically in a few seconds.

You will be unable to enter any character which is not part of an instruction or request. To delete an entry before ENTER has been pressed, press any key that will not make a legal command.

No entries may be made during an update, which lasts less than a second. Once you begin an entry you will have only a few seconds to complete it before the computer clears it from the instruction area. If you do not receive a "ROGER," your entry was not processed.

Clock

At the beginning of the game you are asked to enter a clock setting. This must be a decimal number between 16 and 99. After entering the setting, press the return key and the game begins. You will be unable to enter an illegal setting, and pressing any key but ENTER will delete your entry. The first clock advance comes in about 15 seconds. After that they are (approximately) one minute apart.

No aircraft becomes active until the clock has advanced once. This gives you enough time to study the arrivals due in one minute. No aircraft becomes active during the last 15 minutes of the game. This is to give you time to handle all aircraft before the time runs out.

Entries made during a minute will affect clock speed. In no case may more than 16 entries be made in a single minute. To speed up the clock during periods when nothing is happening, tap the space bar until the clock advances.

Since 26 aircraft become active regardless of game length, it follows that the smaller the initial clock setting, the more difficult the game. In practice, settings above 60 or so tend to produce a dull game, whereas settings below about 20 are nearly impossible to win. 99 is good only for getting the feel of an aircraft without worrying about conflicts. Of course, the pseudo-random number generator sometimes produces extremely unusual and challenging games at any setting.

End of Game

The game ends with one of the following indications:

BOUNDARY ERROR
CONFLICT
FUEL EXHAUSTED
= = TIME = LIMIT = =
•••SUCCESS•••

The first three will be followed by the call sign of the aircraft involved. In the case of conflict both aircraft involved will be displayed, and the position in your control area where the conflict occurred will be occupied by the conflict marks @@. The conflicting aircraft will remain in its old position next to the marks to show you the move that caused the conflict.

Following the above will be the number of aircraft, both active and inactive, that you failed to get to their destinations.

To end the game at any time enter a dollar sign ($).

To start another game press '•'.

ATC MAP •

• = M   x = mx
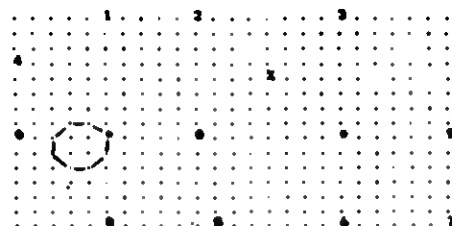
. MILE MARKER
0-9 ENTRY/EXIT FIXES
$ AIRPORTS
• NAVAIDS
- - - TYPICAL HOLDING PATTERN (NOT DEPICTED ON SCREEN)